Executive Summary

Volatile organic compounds (VOCs) play a primary role in the reaction scheme leading to the formation of tropospheric ozone. During this contract, we were able to measure a wide variety of VOCs over California, focusing on the characterization on the lower troposphere of important source regions such as the San Joaquin Valley (SJV), the Los Angeles (LA) air basin and, in general, the South California air basin (SCAB). The improved knowledge on the speciation of VOCs over California is crucial for the improvement of state emission inventories for greenhouse gases and aerosol, for the characterization of offshore emissions of sulfur and other pollutants from shipping and natural sources, and for the characterization of upwind boundary conditions for modeling local surface ozone and $PM_{2.5}$.

Whole-air samples were collected on board the NASA DC-8 aircraft during several research flights (ARCTAS-CARB study) carried out in June 2008. These samples were analyzed at the University of California, Irvine for more than 75 gases, including nonmethane hydrocarbons, halocarbons, alkyl nitrates, sulfur compounds, and oxygenated compounds.

Among the different halocarbons, we measured several important greenhouse gases such as CFC replacement compounds. We were able to characterize the distribution over California of three HCFCs (HCFC-22, HCFC-142a, HCFC-141a) and two HCFs (HFC-134a and HFC-152a). We focused our attention on the LA basin and on one of the fastest increasing species, namely HFC-152a. Using the data obtained during the flights over the LA air basin we were able to extrapolate the annual emission of HFC-152a and evaluate the role of the United States on the HFC-152a global emissions. We also used an air quality model to validate our results and we found a very good agreement between the emissions predicted by the urban model and the emissions calculated using the observation obtained over the LA basin during the different research flights.

Finally, this contract allowed us to observe the background levels of selected oxygenated compounds over the SJV, and ultimately to evaluate the enhancement of such species through both the east and the west sides of the valley. An assessment of the emissions of the oxygenated compounds in the valley was achieved using data

obtained on board the DC-8 on low altitude flights through the valley. Among these species, we found that ethanol, methanol, and acetaldehyde were produced in major quantities throughout the SJV as by-products of yeast fermentation of silage and photochemical oxidation. These oxygenates play an important role in ozone formation within the valley. Based on our observations, we were able to distinguish between cities versus dairy emission sources.